1. A superconducting electric motor comprising:

a rotor assembly including:

at least one superconducting winding which, in operation, generates a flux path within the rotor assembly; and

a support member which supports the at least one superconducting winding, the rotor assembly configured to operate in a synchronous mode of operation at temperatures wherein the superconducting winding exhibits superconducting characteristics and in a steady-state induction mode of operation at temperatures wherein the superconducting winding exhibits non-superconducting characteristics.

2. The superconducting electric motor of claim 1 wherein the rotor assembly includes induction structure for carrying current at levels sufficient to allow the steady-state induction mode of operation.

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3. The superconducting electric motor of claim 1 wherein the rotor assembly includes induction structure configured to allow the superconducting motor to generate a starting torque which is at least 50% of the rated torque in the induction mode of operation.

4. The superconducting electric motor of claim 3 wherein the rotor assembly includes induction structure configured to allow the superconducting motor to generate a peak torque which is approximately twice the rated torque in the induction mode of operation.

5. The superconducting electric motor of claim 4 wherein at least a portion of the induction structure is

spaced from the at least one superconducting winding by a thermal isolation vacuum region.

6. The superconducting electric motor of claim 5 wherein said at least portion of the induction structure spaced from the at least one superconducting winding by a thermal isolation vacuum region includes an electromagnetic shield member.

7. The superconducting electric motor of claim 6 further comprising a cryostat positioned between the thermal isolation vacuum region and the electromagnetic shield member.

8. The superconducting electric motor of claim 5 wherein said electromagnetic shield member includes a conductive, non-magnetic material.

9. The superconducting electric motor of claim 4 wherein the induction structure includes the support member which supports the at least one superconducting winding.

10. The superconducting electric motor of claim 9 wherein the induction structure further includes an electromagnetic shield spaced from the at least one superconducting winding by a thermal isolation vacuum region.

11. The superconducting electric motor of claim 10 wherein the support member includes a plurality of laminations, each lamination lying in a plane parallel to magnetic field flux lines extending through the laminations during operation of the superconducting electric motor.

12. The superconducting electric motor of claim 1 further comprising:

a stator assembly electromagnetically coupled to the rotor assembly; and

an adjustable speed drive provides an electrical signal to the stator assembly.

13. The superconducting electric motor of claim 12 wherein the adjustable speed drive provides a signal at a first frequency to the stator to start the superconducting motor in the synchronous mode of operation and provides a signal at a second frequency, less than the first frequency, to the stator in the steady-state induction mode of operation.

14. The superconducting electric motor of claim 1 wherein the superconducting winding includes a high temperature superconductor.

15. The superconducting electric motor of claim 1 wherein the superconducting winding is a racetrack shaped winding.

16. The superconducting electric motor of claim 1 wherein the support member is formed of aluminum.

17. A superconducting electric motor comprising:

a rotor assembly including at least one superconducting winding comprising a high temperature superconductor, the superconducting winding, in operation, generating flux within the rotor assembly, the rotor assembly and stator assembly configured to operate in a

synchronous mode of operation at temperatures wherein the superconducting winding exhibits superconducting characteristics and in an induction mode at temperatures wherein the superconducting winding exhibits non-superconducting characteristics;

a cryostat surrounding the rotor assembly to maintain the at least one superconducting winding at cryogenic temperatures; and

induction structure, which during operation, carries current at levels sufficient to allow the steady-state induction mode of operation of the superconducting electric motor, the induction structure including:

a support member which supports the at least one superconducting winding; and

an electromagnetic shield surrounding the cryostat and the at least one superconducting winding.

18. The superconducting electric motor of claim 17 further comprising:

a stator assembly electromagnetically coupled to the rotor assembly; and

an adjustable speed drive provides an electrical signal to the stator assembly.

19. The superconducting electric motor of claim 18 wherein the adjustable speed drive provides a signal at a first frequency to the stator to start the superconducting motor in the synchronous mode of operation and provides a signal at a second frequency, less than the first frequency, to the stator in the steady-state induction mode of operation.

20. The superconducting electric motor of claim 17 wherein the support member includes a plurality of laminations, each lamination lying in a plane parallel to magnetic field flux lines extending through the laminations during operation of the superconducting electric motor.

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21. A method of operating a superconducting electric motor of the type including a rotor assembly including at least one superconducting winding which, in operation, generates a flux within the rotor assembly, and a support member which supports the at least one superconducting winding, the method comprising:

monitoring the temperature of the superconducting winding;

operating the superconducting motor in a synchronous mode at a temperature wherein the superconducting winding exhibits superconducting characteristics; and

operating the superconducting motor in a steady-state induction mode at a temperature wherein the superconducting winding exhibits non-superconducting characteristics.

22. The method of claim 21 wherein operating the superconducting motor in the synchronous mode includes providing an electrical signal to a stator assembly, electromagnetically coupled to the rotor assembly, the signal having a first frequency; and

operating the superconducting motor in the steady-state induction mode includes providing a signal to the stator assembly at a second frequency, less than the first frequency.